Winter 2008

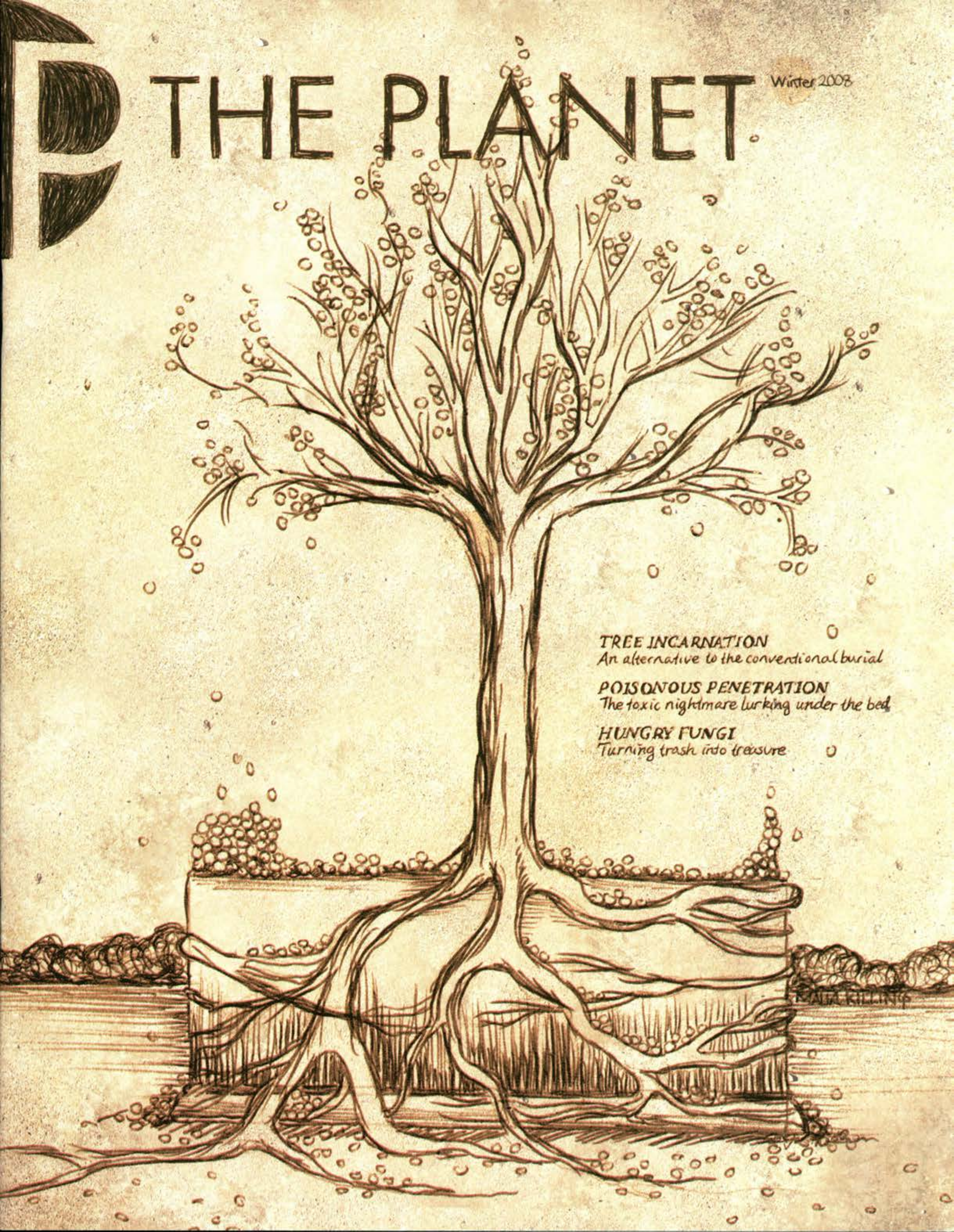
# The Planet, 2008, Winter

Page A. Buono
*Western Washington University*

Huxley College of the Environment, Western Washington University

# THE PLANET

Winter 2008



TREE INCARNATION
An alternative to the conventional burial

POISONOUS PENETRATION
The toxic nightmare lurking under the bed

HUNGRY FUNGI
Turning trash into treasure

MAIA KILLING

Dear reader,

In our society we live and operate with an 'act now, think later' mentality. The implicit danger of this thoughtless practice is that often, by the time consequences are fully realized, it is too late.

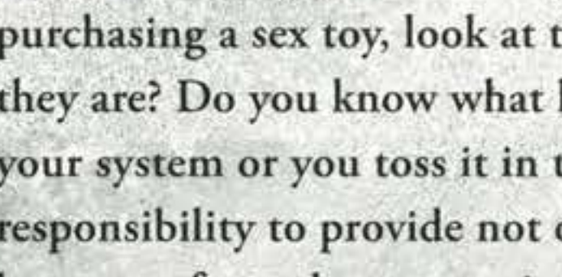
The phthalate story in this issue of The Planet gives an example of products that, had they undergone more rigorous testing, may not have made it into our markets, and consequently into our bodies. The piece about green burials highlights an unquestioned interment tradition we take to the grave that continues to dump massive amounts of chemicals into our soil. Unfortunately, with these examples and more, it is not just a matter of turning a cheek, but the deliberate action of applying a tightly knotted blind-fold that makes us not only passive observers but willing contributors to destructive processes and unregulated technology.

Occasionally we take measures to repair damage, which this issue's story on mushrooms demonstrates. We sometimes have the means, and thankfully the effort from people like environmental lawyers or organizations like the Washington Conservation Corps, to clean up our environmental errors— but not always. Regardless of remedies, it seems this energy could have been channeled into creating new processes, cures and inventions—rather than cleaning up messes.

When you are staring at the shelf of toothpaste or purchasing a sex toy, look at the ingredients. Do you know what they are? Do you know what happens to the product after it leaves your system or you toss it in the trash? As producers, it is their responsibility to provide not only ingredient lists and warnings, but to perform the appropriate testing before releasing a product into the market. As consumers, it is our responsibility to demand accurate information, and to purchase according to results.

We appreciate your readership and encourage comments or questions in the form of email, letters or conversation.

Sincerely,



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Page A. Buono

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Danielle Koagel
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Anna Renzetti
Natasha Walker
Megan Claflin
Allison Rock
Kassidy Vietti

ADVISER
William Dietrich

COVER
Malia Killings

ADDRESS
The Planet
c/o Huxley College
Western Washington
University
516 High Street, CF 220
Bellingham, WA 98225
360.650.3543

EMAIL
planet@wwu.edu

WEBSITE
http://planet.wwu.edu

*This issue of The Planet is printed on Mohawk Options 100 percent PC Cool White Smooth paper. It is made from 100 percent postconsumer waste fiber through non-polluting, wind generated energy and printed with soy-based inks.*

# CONTENT

**04 Intimate Danger**
*An in-depth look at the health dangers of toxins, such as phthalates, in sex toys.*

**07 Law and the Natural Order**
*Despite growing up in a family of insurance defense lawyers and a degree from Harvard Law School, David Bricklin sacrificed making lots of money to become an environmental lawyer.*

**10 Invisible Industry**
*Tiny technology is revolutionizing the industrial world. But nanotechnology's behavior in both the human body and the environment is cause for concern.*

**13 Feel the Sting**
*Honeybees are rapidly disappearing and scientists are unable to pinpoint a cause. Farmers and beekeepers fear the loss of one of agricultures most valued tools.*

**16 Sustainable Sizzle**
*Fiamma Burger, Bellingham's new sustainable restaurant, serves America's favorite fast food with natural beef, clean energy, and 90 percent compostable and recyclable waste.*

**18 Green Burials**
*Modern funerals are costly affairs for both consumers and the environment. Embalmed remains and hardwood coffins inhibit decay and tack on thousands of dollars to burial expenses—leading many to seek a greener way to go.*

**21 Outback in Business**
*The Outback Outdoor Experiential Learning Site has historically been ignored or unknown by most. Student gardeners hope it grows into a welcoming and accessible place for everyone.*

**24 Shroom Vacuum**
*The new leaders in environmental cleanup are some of nature's oldest recyclers. Mushrooms emerge from the shadows, turning toxins into harmless compounds.*

**28 Green Collar Restoration**
*Washington Conservation Corps works to restore Bellingham's natural resources.*

**30 Tainting Traditions**
*Marine contaminants are infiltrating Washington's shellfish and placing coastal Native Americans' health in jeopardy. The consequences are steep, but the loss of the harvesting tradition may be greater.*

**33 Raising Cane Against Carbon**
*Bamboo may now rise to it's full potential. A new cloning strategy makes this carbon-reducing resource more available.*

# INTIMATE DANGER

The phallic playthings dangle along the back wall of Lovers. Lined up on a shelf, their sparkly glitter insides shine through the thick layer of packaging, but something more sinister is also lurking in the sexy line up of jelly rubber dildos, vibrators and anal beads.

Written by **Danielle Koagel**
Photos by **Elizabeth Olwin**


*Babeland Sex Educators address a crowd of WWU students on the use of sex toys on Feb. 20.*
LEFT *Photo Illustration by Elizabeth Olwin*

New studies on phthalates, a chemical compound found in jelly-rubber sex toys, suggest that sex-toy users should be wary of what's in their pleasure playthings.

Phthalates (thal-ates) are the most commonly used plasticizers in the world. They are found in everyday items such as adhesives, nail polish and paint. They are a popular material in sex toys and other products because of their cheap production cost and ability to make rubberized plastic toys soft and flexible.

Phthalates are found in children's toys, but were recently banned by the European Union and California due to a link between high phthalate levels and health problems in developing fetuses. However, the use of phthalates by sex toy manufacturers remains completely unregulated and untested due to the government classification of all sex toys as novelty items or "gag products."

According to the European Phthalates Information Centre, phthalates refer to a group of chemical compounds derived from phthalic acid. Phthalates are added to plastics to make hard plastic more flexible, which they do by allowing the otherwise rigid polyvinyl molecules to slide against one another.

Phthalates are most commonly found in jelly-rubber sex toys. Sex toys refer to a variety of products including cock rings, vibrators, masturbation sleeves, anal beads and dildos. Most sex toys are for internal use in the vagina or anus, although this isn't always the case. Jelly-rubber toys are distinguished by their soft squishy feel and strong chemical 'new car' smell, and they often come in an array of bright colors, shapes and sizes. Phthalates are in many sex toy products, but are found in higher concentration in dildos and vibrators.

Audrey McManus is the marketing and education manager at Babeland, a sex toy store in Seattle. She said the staff at Babeland makes sure customers know what they are getting into, or rather, what's getting into them, when they buy products that contain phthalates.

"We hand out information sheets on phthalates to all of our customers," McManus said. "And we always recommend putting a condom on jelly-rubber sex toys before use."

McManus said Babeland has pulled a lot of its jelly rubber products off the shelves in recent years after studies done on rodents suggested phthalates could be harmful to reproductive health. McManus said she had her suspicions about the safety of the toys.

"I don't need a study telling me these toys are harmful," she said. "The smell is overwhelmingly toxic with chemicals."

McManus said toys with phthalates are popular because of their cheap price. Only 5 percent of Babeland's toys contain phthalates because of their status as potentially harmful. Babeland employees try to suggest alternative materials, such as silicone and hard plastic.

According to McManus, most jelly rubber toys cost an average of $22 while alternative materials like silicone tend to cost an average of $65. She said Babeland keeps a small number of these products on the shelf to provide a cheaper alternative for customers who can't afford higher quality materials.

"Sometimes it's just not practical for people to spend that much on a toy," McManus said. "So they put a condom on it and take their chances."

Even putting a condom on a jelly-rubber toy isn't 100 percent safe because phthalates are slowly released in a gas form which condoms aren't designed to protect against, McManus said.

At the Bellingham Lovers store, part of a national chain of adult stores, customers were surprised to learn the collection of vibrators they were browsing is a potential health hazard.

"Since when did vibrators get so complicated?" one customer said.

Tracy Dahlstedt, education programs manager of the Mount Baker Planned Parenthood, said she worries that the outgassing chemicals of phthalate sex toys will enter the blood stream through the vagina or anus and have long-term health consequences. However, because only limited studies have been conducted and none have been long-term, she said she doesn't know enough to properly inform patients about potential risks.

Phthalates are classified as "endocrine disruptors" because of the way they mimic the body's hormones after entering the blood stream. Studies have shown that phthalates' ability to recreate the body's hormones can cause reproductive and neurological damage.

Phthalates were recently banned in children's toys in California and the European Union due to

# IDENTIFYING PHTHALATES IN COMMON PRODUCTS

*Common chemical names (abbreviations) to be wary of, and the products that contain them.*

| CHEMICAL NAME | PRODUCTS |
|---|---|
| **DBP** *dinbutyl phthalate*<br>**DEP** *diethyl phthlate* | Nail polishes, deodorants, perfumes |
| **DEHP** *di-ethylexly pthlate*<br>**Bis** *ethylhexyl pthlate* | PVC plastics, including some medical devices |
| **BzBP** *benzylbutyl pthlate* | Flooring, car products, some personal care products |
| **DMP** *dimethyl phthalate* | Insect repellent and some plastics |

fear that children would ingest the chemicals by putting the toys in their mouths.

The ban of phthalates in children's toys in California was enacted after researchers at the University of Missouri found that women with high amounts of phthalates in their blood were more likely to give birth to boys with reproductive organ abnormalities. Other studies on rodents have shown a link between high phthalate exposure and damage to the liver, lungs, kidneys and developing testes.

According to the Phthalates Information Center Web site, the center works closely with government agencies so these materials can continue to be used safely in a wide array of products. Formed in 1973, the information center is an industry group composed of all major manufacturers and users of primary phthalates in U.S. commercial commerce, including BASF Corp., Eastman Chemical Co. and Exxon Mobil Chemical Co.

The site examines the benefits of phthalates in everyday products and endorses their use in children's toys, medical equipment and cosmetic products.

Marian Stanley, manager of media relations at the Phthalates Information Center, said no studies have been conducted to test the effects of phthalate exposure in sex toys. Most studies relating phthalate exposure to its effects on human subjects haven't been able to draw a direct correlation to health problems. The only tests that successfully link phthalates to health risks have been on rodents.

"Studies on rodents are inadequate because they measure a toxic level of phthalates that wouldn't normally be seen in humans," Stanley said. "The average human would simply pass phthalates through their system."

Stanley said she believes the media has blown the dangers of phthalates out of proportion by cherry picking inconclusive results from a few studies.

"Phthalates are about a millionth of a percent of most products," Stanley said. "They are even used in medical equipment because of their clear, strong, flexible and sterile quality."

Janette Casolary, coordinator for Western Washington University's Sexual Awareness Center, said she has noticed a difference in sex toy products containing phthalates and those that don't. She said jelly-rubber toys often give off a strong plastic smell and can get slimy and smelly if left in an enclosed casing for a long period of time.

"They might be cheaper," Casolary said. "But they're impossible to disinfect because they are quite porous and they melt if you use a disinfectant like bleach on them."

Dahlstedt, of Planned Parenthood, said sex-toy users are often unaware of the consequences of improperly cleaned sex toys. She said reusing dirty toys can lead to a multitude of bacterial infections, including sexually transmitted diseases and yeast infections.

"Sharing or reusing a toy without a condom and proper cleaning carries the same risks as having unprotected intercourse," Dahlstedt said.

Casolary said even though most adult shops sell disinfectant cleaners, such as Safe Suds, the porous nature of jelly-rubber is designed to trap bacteria even after a thorough washing.

She said other materials, like silicone, are safe to boil, put in the dishwasher, disinfect in the microwave or even store in the freezer to keep the toy sterile.

"Most adult stores in the Bellingham area will let you know how to properly clean a toy," Casolary said. "You just need to make sure you go somewhere where the staff is knowledgeable and not just worried about making the sale."

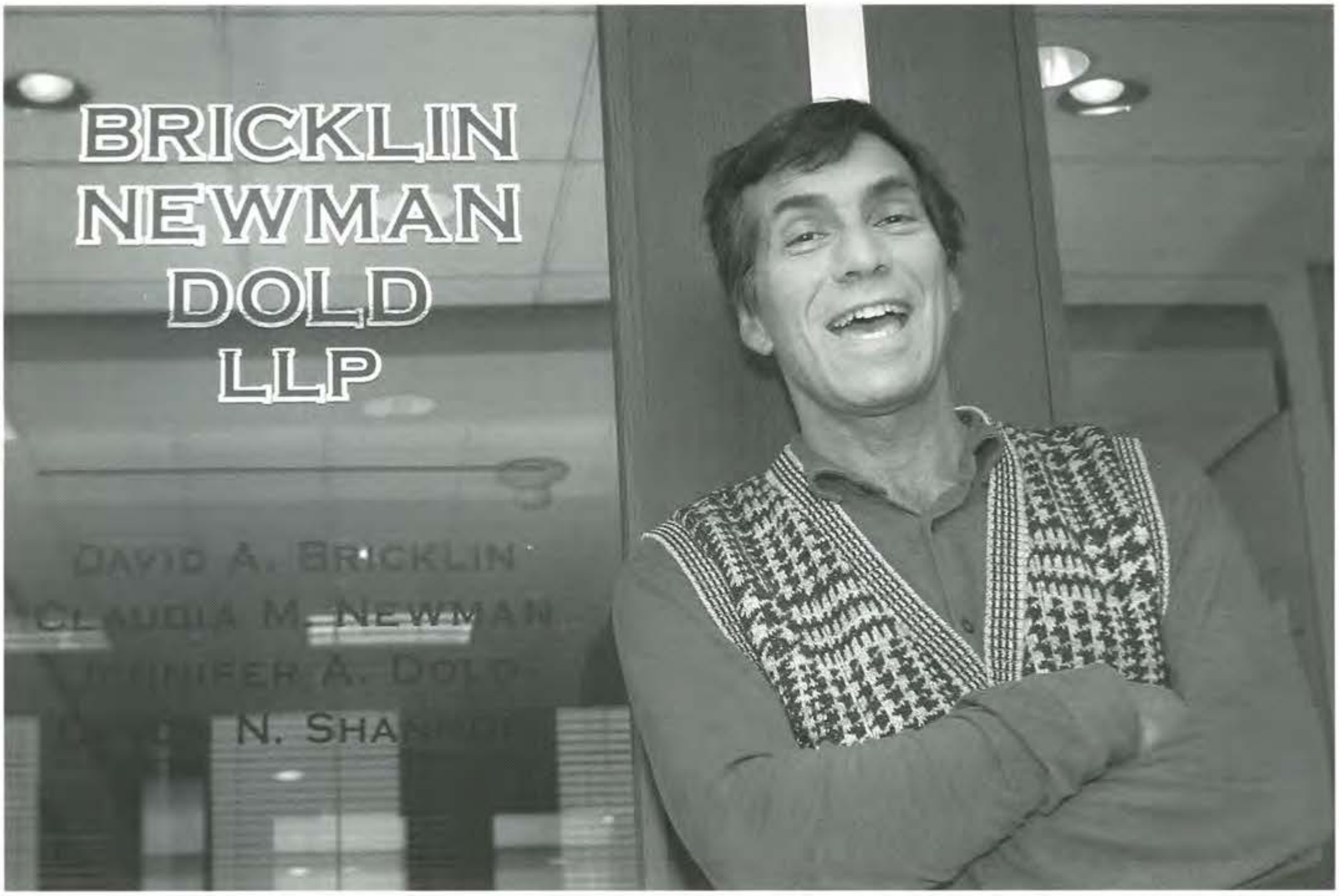
Casolary said she personally recommends Babeland and Lovers because of their extensive knowledge about the safety of their products.

Casolary said she was disturbed by the government's lack of action in regulating phthalate use, and thinks the government needs to recognize the common use of these products and test them rigorously for safety.

McManus said she was also concerned about the sale of sex toys as novelty items, but said she thinks it is the duty of adult shop owners to help their customers make informed decisions about the risk that comes with using a toy containing phthalates.

"I know how I feel about it," McManus said. "If the government says children shouldn't be putting it in their mouths, I certainly don't want to put it in my vagina."

**Danielle Koagel** studies journalism. She has been published in The Seattle Times, The Western Front, The Enterprise and The Ebbtide.




*David Bricklin poses in front of his office doors in Seattle, Wash. (Photo by Sho'leh Moll)*

Written by **Kassidy Vietti**

# Law and the natural order

***As he rides his bike off the ferry in a tight, bright yellow biking outfit and cycling cleats, David Bricklin hardly looks like the poster-child for a high-profile law firm in Seattle. Nonetheless, Bricklin has argued hundreds of cases in his 30 years of practicing environmental law, one in the U.S. Supreme Court.***

Bricklin has biked daily from his home on Bainbridge Island to the ferry that takes him to his office in downtown Seattle for more than 11 years. His other vehicle is a blue mini van.

"Some people went to law school because they wanted to be a lawyer and make money like Perry Mason," Bricklin said. "But I went to law school because I wanted to do good things and protect the environment."

In addition to being the president of the Washington Environmental Council, Bricklin was involved in the development of the Growth Management Act, which protects natural resource lands and forces designation of urban growth areas. He also co-authored the Model Toxics Control Act, which identifies and cleans contaminated properties that are or may become a threat to humans and the environment.

"The air, water, animals and plants can't defend or speak for themselves," Bricklin said. "I always wanted to help the needy, and no one needs us more."

Growing up, Bricklin's father worked as an insurance defense lawyer in Philadelphia. His older brother, Louis, continued his father's work defending insurance companies who were trying to avoid paying what they were supposed to under their insurance policies.

Bricklin admits that from the beginning, he had no intention of following in his father and brother's steps and doing insurance defense work.

"Law was a means of having an impact on social policy," Bricklin said.

Bricklin said his love for the environment was evident even at the young age of five.

"I remember pulling the petals back on a rhododendron that was still closed and wanting to see what was inside," he said. "But then I remember feeling sad I had destroyed it and knowing it was never going to be a flower."

As an environmental lawyer, Bricklin has focused the majority of his career in dealing with land-use laws.

Bricklin has worked with issues such as protecting forest lands, farm lands, rural areas from urban sprawl, dealing with overcrowded roads and transportation issues, stabilizing slopes and protecting aquifers from development pressures.

After graduating from Michigan State University in 1974, Bricklin studied at Harvard Law School and graduated in 1977.

Soon after moving to Seattle, Bricklin met his wife, Anne, to whom he has been married for 23 years. He adopted her daughter, Jennifer, 31, from a previous marriage when she was 9 years old. Anne and he then had triplets: Jacob, Alex and Laura, 15, who Bricklin describes as athletic and smart.

"All of the pictures in my office are of threes," Bricklin said with a smile.

Thirty-one years after law school, and 33 floors above the ground in the Safeco Plaza building, Bricklin's office exudes his profession. A desk is barely visible beneath the stacks of legal documents. A well-used phone and computer peek out through the paper towers. Pictures of children and family cover almost every wall.

The view of the ocean and the city below is breathtaking. Change the biking outfit into a sweater vest and khakis, and Bricklin appears to fit the description of a lawyer.

On average, Bricklin said he works about 50 hours a week.

"There's a room on the ferry that's quiet, it's like a library," he said. "It's my best working time of my day. It's quiet, no phone calls, no interruptions."

Bricklin said it's difficult to categorize a case as a win or a loss because the verdict may simply reduce the environmental impact. He said he has never really thought about his win-loss record or what he calls his "batting average."

"When you're challenging positions made by the government, it's an uphill climb because the laws are written in a way that gives deference to them," he said. "You start off with the cards stacked against you and so winning any of these cases is a long shot. If I win one out of three cases, I think I'm doing great."

On the other hand, there are clear victories, like a case Bricklin worked on for two years which brought him to the Supreme Court.

In 1987, Bricklin was asked to represent a group of people who lived in the Methow Valley in the North Central Cascades near Twisp and Winthrop. The Methow citizens were fighting corporations that proposed to develop a ski area similar to Whistler.

"It would have changed the whole fabric of the valley and to the environment," Bricklin said. "It would have changed what it was like to live there. It's a very rural, beautiful spot in the mountains; the wildlife is rich and abundant and the water is clear."

A new ski resort would not only have affected the small-town community, but also the wildlife and their habitat. The citizens believed the new resort would spur development of the surrounding area, turning wild lands into lots for new homes.

Most elected officials and even the governor were speaking out in support of the new ski resort. Tensions increased when it was discovered that a member of Congress had added a sentence on a committee report that was in favor of the ski resort.

The committee reports summarize the bill and testimonies that are given for and against it. The sentence went unnoticed until it was cited in legal briefs filed in court as indicative of "congressional will."

"In reality," Bricklin said. "it was indicative of the ability of one member of Congress to add a sentence to a committee report that no one was paying attention to at the time."

Despite the messy trial, on May 1, 1989, in the case of Robertson vs. Methow Valley Citizens Council, the judge ruled in favor of the Methow citizens. Plans for a large-scale ski resort became only a distant nightmare to the local citizens.

"When we won that case I said, 'if I never do anything else in my career as an environmental lawyer, I can feel satisfied I saved a whole valley,'" Bricklin said. "It was a really loaded case and so for us to prevail on that was really neat."

Bricklin said he attributes his win to preparation and the confidence it gives.

"When I found out the case for the ski resort in Methow Valley was going to be heard in the Supreme Court, I went back my office and threw up," Bricklin said with a laugh. "I could not have prepared any more thoroughly for that case and as a result, on the day when I walked into the court room, I was actually much more relaxed."

Bricklin said there is a limited amount of money to support the work of a public interest environmental lawyer.

"Public interest environmental lawyers are people who are attempting to advance the cause of environmentalism," said Richard Smith, an environmental lawyer and acquaintance of Bricklin. "The jobs are very hard to get. It's really unfortunate that it's hard to make a living doing this work and there are so few opportunities to do it."

Even Bricklin's opponents seem to be charmed by his easy-going demeanor and impressed by his persuasiveness in the court room. Land use lawyer, Jack McCullough has represented controversial clients such as Wal-Mart and has worked about 20 cases against Bricklin and his firm.

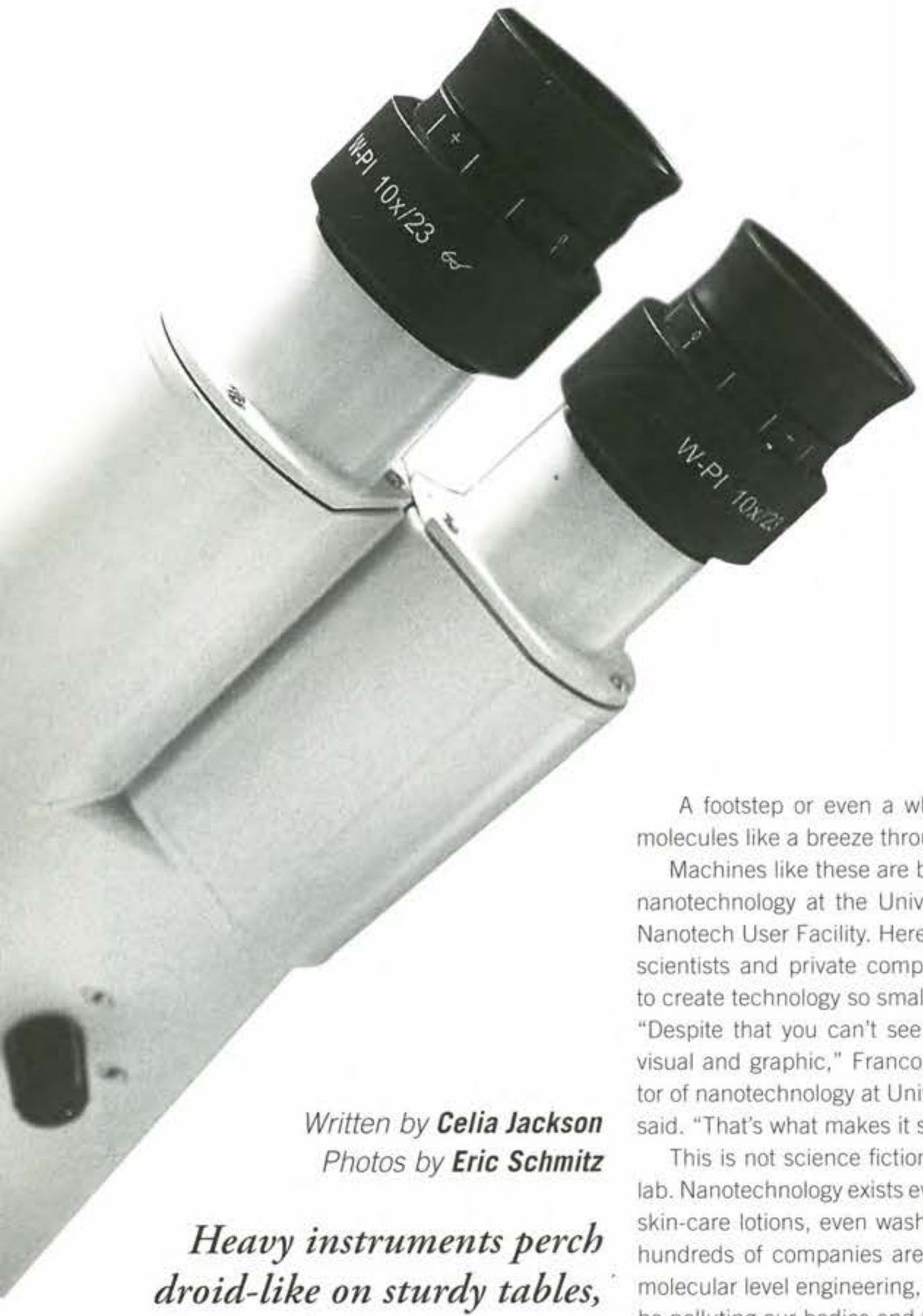
"He's very bright. He's very articulate and he's very persuasive," McCullough said. "I can always count on him to find a new angle or wrinkle in a case that I hadn't thought of before, so I look forward to these cases that we work on because I know he'll be challenging in unexpected ways. He's about as tough an advocate as there is right now."

**Kassidy Vietti** studies journalism. She has been published in The Western Front.

"The air, water, animals and plants can't defend or speak for themselves," Bricklin said. "I always wanted to help the needy, and no one needs us more."

*David Bricklin poses in front of the Bellingham Court House. (Photo by Erin Middleton)*

# INVISIBLE INDUSTRY




*Written by* ***Celia Jackson***
*Photos by* ***Eric Schmitz***

***Heavy instruments perch droid-like on sturdy tables, each providing a unique view of the molecular world. Some of the instruments measure to lengths so small, the very vibration of sound disturbs their images.***

A footstep or even a whisper can ruffle the molecules like a breeze through leaves.

Machines like these are behind the science of nanotechnology at the University of Washington Nanotech User Facility. Here at the lab, students, scientists and private companies come together to create technology so small light misses it.

"Despite that you can't see it, it's actually quite visual and graphic," Francois Baneyx, the director of nanotechnology at University of Washington said. "That's what makes it so sexy."

This is not science fiction confined solely in a lab. Nanotechnology exists everywhere: in clothes, skin-care lotions, even washing machines. While hundreds of companies are taking advantage of molecular level engineering, nanotechnology may be polluting our bodies and the environment.

A nanometer is to a meter as a soccer ball is to the Earth, or 10,000 times narrower than a human hair, according to the University of Washington (UW) Department of Nanotechnology.

Qiuming Yu, the lab manager and principal research scientist at the Nanotech User Facility, has seen a shift from academics to industry and a skyrocketing interest in nanotechnology. The lab has seen 200 new users in the last year, Yu said.

"Before it was just lab research," Yu said. "Now it's moved from research to development."

Some new developments in nanotechnology have met resistance from the Environmental Protection Agency (EPA) and other regulatory bodies worried about possible human and environmental health risks.

On Jan. 28, 2008, the EPA launched its new Nanoscale Materials Stewardship Program to help the agency better understand how nanotechnology is used in industry, and what kinds of risk management practices are used. The basic program invites companies to voluntarily report their data to the EPA. It's not a regulatory system; it simply gathers information. This will help the agency make informed regulatory decisions, according to the EPA.

The cosmetics industry serves as an example of nanomaterials being put on the market before the effects on consumer and environmental health are known. L'Oreal, Clinique and Neutrogena are not names usually associated with nanotechnology, but they are some of the top producers of products containing nanomaterials.

Nanomaterials are popular in cosmetics because of their ability to deeply penetrate skin tissue. They function as transporters for key ingredients in skin care products, many of which are anti-aging creams. Users of cosmetics, which are often applied on a daily basis, are especially prone to the triple threats of tissue penetration, inhalation and ingestion of nanomaterials. But the effects of nanomaterials in the body is relatively unknown.

Nanotechnology is currently controlled under the U.S. Toxic Substances Control Act (TSCA), which reviews new chemicals for environmental or human-health hazards, according to the EPA. The TSCA has an inclusive inventory list of "existing" chemicals, but nanotechnology hangs in a scientific limbo.

The EPA reviews chemicals under the TSCA according to molecular composition, but a nano-sized substance may only be a smaller version of an existing chemical. Although a smaller structure may exhibit different physical and chemical properties, nanotechnology is not reviewed separately, according to the EPA.

Last year the EPA issued a ruling that classified a new washing machine by Samsung as a pesticide producer because it released nano-silver particles to kill germs in clothing. Wastewater from the machines containing nearly 100 quadrillion silver ions could reach public water systems with unknown effects. Studying environmental effects is part of an assessment program that Samsung will have to undergo in an approval process planned for completion in May of 2009, according to the EPA.

Ionized silver nanoparticles are used to kill germs. They can be applied as a sealant or a spray, and many companies are beginning to apply nanosilver on kitchen countertops, sinks, couches, and other household items. Despite its sanitizing qualities, nanosilver may be more reactive and require new standards to protect human and environmental health.

"My concern would be evolution of resistance," Baneyx said.

In the same way that insects become immune to pesticides, microbes could develop resistance to silver.

Working at nano scale changes certain properties, including reactivity, that could affect how materials behave in the environment. As a material gets smaller, the ratio of surface area to volume increases, providing more area for chemical reactions, according to Nigel Purchon, a biology teacher and author of a Web site serving science educators in the United Kingdom. This is similar to taking a slice of bread and cutting it into smaller and smaller parts. Every time the bread is cut, there are more sides to spread butter on, according to Purchon's Web site.

Nanomaterials also vary widely in shape, an important factor in carcinogenic studies. Materials like asbestos cause cancer because their size and shape allow them to slip into the cracks of DNA and damage proteins in the lungs.

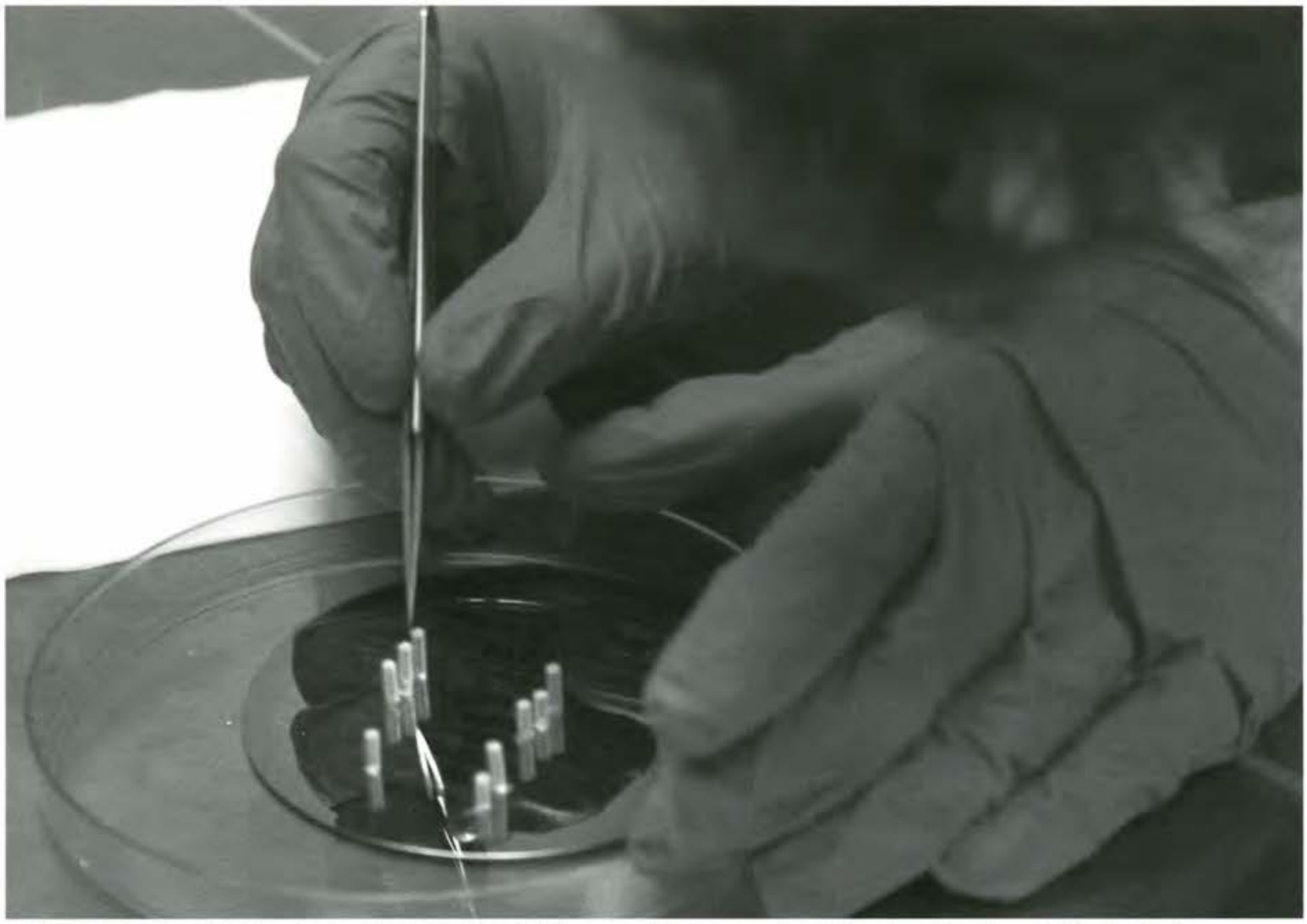
Nanomaterials are so small they can enter the blood stream through skin membranes, and have been shown to cross into brain tissues, Baneyx said.

A study by the National Institute of Occupational Safety and Health (NIOSH) in 2005 saw severe DNA damage in the heart and arteries of lab mice when exposed to carbon nanotubes.

A study by the National Aeronautic and Space Administration (NASA) in 2005 indicated risk for inhalation of carbon nanotubes. In the study, the lungs of rats were injected with nanotubes at levels nanotechnology employees are exposed to over a 17-day period. The rats experienced severe lung damage.

The U.S. has invested less than $40 million for health and safety research in an industry currently worth $30 billion, according the Woodrow Wilson International Center for Scholars. In 2014, only six years away, nanomaterials are projected to make up $2.6 trillion of the global market. Around 400 products are currently advertised as using nanomaterials. In 2006, the most popular were gold, titanium dioxide, silica, zinc, carbon and silver, according to the Woodrow Wilson Center.

"Despite that you can't see it, it's actually quite visual and graphic," Baneyx said. "That's what makes it so sexy."



*ABOVE AND PREVIOUS Paul Wallace readies a Petri dish full of nano particles for tests at the University of Washington in Seattle, Wash.*

Although health and safety research is being done, studies are conducted by private companies and voluntarily reported to governmental agencies.

In Berkeley, Calif., city officials have created legislation requiring companies to disclose information on certain nanomaterials. Although the law only covers materials used in Berkeley, other cities are following suit. Cambridge, Mass. is looking into creating its own regulations.

Counties and cities can create more stringent laws than their state, in the same way states can be more stringent than the federal government. But regulating the use and disposal of potentially dangerous products is challenging. It's difficult to regulate what people throw away in the trash, said Jeffery Hegedus, the Environmental Health Supervisor for the Whatcom County Health Department.

Bellingham has not looked into regulating nanotechnology. However, Washington State's Safety and Health Assessment and Research for Prevention (SHARP) program works with companies to help study the nanotechnology they employ.

Isotron, a nanotech and polymer science company based in Seattle, works with SHARP. It's important for companies to work with SHARP to assess their technology, said Isotron co-founder Christina Lomasney. Nanotechnology is such a broad science that it's hard to relate research across all fields, Lomasney said.

Back at the UW lab, excitement over the possibilities of nanotechnology reigns king. Standards will eventually be developed for determining the toxicity of nanomaterials, Baneyx said. For many chemicals, scientists didn't recognize toxicity levels until years after manufacturers put the chemicals on the market.

While nanotechnology is revolutionizing industry, possible health threats are slowly being discovered. Scientists have the means to determine the potential hazards of nanomaterials, but whether this happens will depend on the thoroughness of governmental regulations and the cooperation of private industry.

**Celia Jackson** studies environmental policy. This is her first published piece.

# FEEL THE STING

Written by **Megan Claflin**

Eric Thompson holds up an example of a section of a beehive in Bow, Wash. (Photo by Todd Linder)

*Few people are aware honeybees are responsible for pollinating one-third of the world's food. But when beekeepers experienced massive losses in 2006, the world took notice.*

In six months an estimated 600,000 of the 2.6 million bee colonies in the United States mysteriously died. Similar reports flooded in from Canada, Spain, France, Brazil and other countries. As the number of dead colonies mounted worldwide, scientists and beekeepers suspected a dangerous new perpetrator.

Scientists theorize the massive decline of honeybees is a result of the insects reacting to environmental stress. Parasites, pesticides, pathogens and most recently an unexplained phenomenon known as Colony Collapse Disorder are under investigation.

With honeybees responsible for pollinating over 200 food crops and three-fourths of the world's flowering plants, agriculturists, beekeepers and consumers are concerned the buzzing bee's could fall silent before science cracks the case.

In the biting cold of early January, Eric Thompson, owner of Belleville Honey in Burlington, Wash., carefully maneuvers a forklift amongst thousands of beehives. With the temperature below freezing, the bees are lethargically clustered inside each box and give little response as they are transferred onto a waiting trailer. As a migratory beekeeper, Thompson supplies nature's best pollinators to farmers across the West.

"I feel like we play one of the most important roles in vegetable and fruit production," Thompson said. "We aren't just this rag-tag group of gypsy beekeepers. Without our work a lot of people would go hungry."

Natural pollinators exist in every ecosystem. But industrial agriculture requires pollination on a massive scale, which wild pollinators can't handle.

Utilized in 90 crops in the United States, the honeybee's contribution increased crop yield and the quality of fruits, vegetables and seeds by an estimated $14.6 billion in 2005, according to

United States Department of Agriculture (USDA).

To meet a steady demand, Thompson keeps his bees working year round. Honeybees are tireless workers, and will forage until physically unable and then will leave the hive, never to return, Thompson said.

"In a given season I will lose 25 percent of my bees," Thompson said. "The harder they work, the faster bees die. Plus, they are killed by things like parasites and disease."

Many threats target honeybees. Parasites such as the varroa destructor and tracheal mites feed on bee blood, like ticks on humans. These parasites severely weaken bees and increase susceptibility to infection and disease, Thompson said. In the 1980s an epidemic of varroa destructor mites destroyed thousands of colonies in the United States.

Beekeepers employ a barrage of chemical and natural supplements to prevent, treat and control parasites. However, treatment could be aiding a deadlier culprit.

Today, scientists suspect some chemical pesticides and fertilizers are poisoning pollinators. Certain chemicals are detrimental to bees' ability to communicate and navigate, according to the USDA. As they nuzzle up to blossoms for pollen they are potentially coating their bodies with toxic chemicals.

"Beeswax is just a sponge for chemicals," Thompson said. "So anything they come in contact with gets stored in the hive with them."

An understanding exists between beekeepers and farmers that no potentially dangerous chemicals will be applied to crops while the bees are pollinating, Thompson said. The USDA requires agricultural chemical manufacturers to print warnings on their labels requiring farmers to avoid use near pollinating bees. However, bees are not easily corralled.

With previous offenses on record, parasites and pesticides are prime suspects for causing bee deaths. But the clues didn't add up. If common criminals were responsible for the epidemic, what had suddenly increased their potency? Scientists knew the guilty party was still at large.

Dr. Steve Sheppard, a professor of entomology at Washington State University (WSU), has been studying bees for 30 years. He is familiar with the usual suspects responsible for sick hives. However, in early January, Sheppard received desperate calls from local beekeepers searching for answers. Traditional solutions weren't working.

"There are many things that can kill bees," Sheppard said. "But I had experienced beekeepers, guys who have been doing this for years, telling me that something just wasn't right."

Seemingly healthy adult honeybees were abruptly disappearing, leaving only the queen and a handful of juvenile bees in the hive. Scientists theorize the adult bees separated and died somewhere away from the hive, because neither new colonies nor clusters of bodies were located. Unlikely to survive alone, the queen and remaining bees quickly died as well, Sheppard said. Scientists named the phenomena Colony Collapse Disorder (CCD).

Responding to the growing crisis, the Agricultural Research Service (ARS), the USDA's chief scientific research agency, held a CCD Research Workshop in April 2007. Eighty bee scientists from multiple organizations contributed, according to ARS.

Researchers examining affected hives discovered the bees were not suffering from one ailment, but from dozens. Pesticide poisoning, parasites, diseases, fungi and malnutrition were some of the conditions identified in affected hives, according to ARS reports. Results showed no consistencies between the hives affected with CCD. No two groups of hives were under the influence of the same affliction. The case of CCD remained unsolved.

Finally in Sept. 2007, intensive genetic screening of hives both affected and not affected by CCD revealed a single commonality in the affected hives, according to ARS reports.

A virus, which until now was only present in Israel, was found in 96.1 percent of the CCD hives. The Israeli acute paralysis virus (IAPV) can be contracted from infected varroa mites. It causes a variety of unusual behaviors including abandonment of the hive, according to ARS, but evidence does not conclude the virus is the cause of CCD.

With conclusive evidence pending, all suspects remain innocent until proven guilty. In the meantime, beekeepers are bringing bees to flowers to prevent a shortage of pollinators.

"Everyone is looking for the silver bullet,"

*Bees hold onto each other in order to find a sense of balance as Eric Thompson checks the hive in Burlington, Wash. (Photo by Todd Linder)*

Thompson said.

While investigations into bee health expand, Sheppard and a team of WSU entomology students are looking to another victim for answers—the queen bee. The number of infertile queen bees has increased in recent years, Thompson said.

"Typically a queen would last two good years, maybe three," Thompson said, "But now I am replacing the queen every year."

Sheppard said a recent study documented declining genetic diversity in the U.S. commercial honeybee population. However, evidence of a correlation between genetic homogeny and declining bee health is inconclusive.

"I have been suggesting beekeepers use multiple queens from different stocks," Sheppard said. "Not putting all your eggs in one genetic basket."

Research to increase queen fertility began with Shepard and his team collecting queen bees from the majority of U.S. commercial breeders. Each queen was examined and evaluated. Queens producing broods with admirable traits such as superior honey production, good hygienic behaviors or resistance to pathogens were inducted into a breeding program, Sheppard said.

Using a process called grafting, researchers select larvae and transplant it into a queenless colony. Worker bees raise the larvae into a queen. Once queens have matured they are donated to partnering bee farms, including the WSU Research and Extension Center in Mt. Vernon, Wash., in an attempt to increase the number of healthy hives in the state. Sheppard's team has successfully bred colonies tolerant of parasites and pathogens. The hives require no antibiotic treatments, Sheppard said.

Studies should facilitate the creation of healthier bees better suited for Washington winters, Sheppard said.

"I believe stronger queens could be the answer to a lot of our problems," Sheppard said. "It is about breeding a better bee."

Back in Burlington, Thompson has finished loading his hives. As scientists and beekeepers collaborate, answers to better bee health are discovered and new methods of maintenance developed. But efforts may prove too little too late for beekeepers and their hives.

"The future of the bee industry is in serious peril," Thompson said. "Without good research and funding we are in a serious fight for our way of life."

**Megan Claflin** studies environmental journalism. This is her first published piece in The Planet.

*Eric Thompson secures beehives onto a truck for transport to California in Bow, Wash. (Photo by Elizabeth Olwin)*

# Sustainable Sizzle

*Written by* ***Elise Watness*** *Photos by* ***Eric Schmitz***

***Since fast food became the American fast feast, hamburgers have been associated with junk food, mediocre ingredients and shameful eating habits. Can a Bellingham burger joint challenge this greasy reputation?***

Fiamma Burger, which opened this summer on Railroad Avenue, is an example of a restaurant practicing environmental sustainability. Fiamma Burger serves naturally-raised beef, runs on renewable energy and recycles and composts 90 percent of its waste.

An average restaurant throws out 8,200 pounds of garbage every month. In comparison, at Fiamma Burger, a 100 to 300 pound family-sized garbage can is picked up once or twice a week, along with four large recycle and compost containers.

Metal and wood décor adorn the walls in Fiamma Burger. The tables are made from the floor of the building's former tavern.

The beef in Fiamma burgers is from Angus cattle at Misty Isle Cattle Company on Vashon Island. The cattle are naturally raised, meaning the meat is free of hormones, antibiotics, and growth stimulants, according to Misty Isle's Web site.

Unlike some restaurateurs, Ken and Dan Bothman, owners of both La Fiamma Wood Fire Pizza and Fiamma Burger, care where the burger ingredients come from. They try to buy locally, but Bellingham doesn't supply all of the ingredients used at Fiamma Burger.

TOP *Carol Ketchum, of Carols' Cows, feeds two of her cows in Fernadale, Wash.*

LEFT *Jim McClure serves up a burger and fries at Fiamma Burger in Bellingham, Wash.*

"I wish I could get beef from here in Whatcom County," Ken Bothman said. "But it isn't available."

Fiamma Burgers have lettuce grown throughout the year by DEVine Gardens, a hydroponic farm in Custer, Wash. that uses biofuel from the restaurants it supplies.

Buying local produce keeps money circulating through the community economy and ensures fresher ingredients, according to eatlocal.net.

Michael Oshman is the executive director and founder of the Green Restaurant Association, a national organization that guides restaurants in environmentally-responsible operations.

The restaurant industry is the largest consumer of electricity in the retail sector and it is important that they are accountable for their impact, Oshman said.

According to the Green Restaurant Association, American restaurants use 33 percent of national retail electricity. Fiamma Burger, however, runs entirely on green power from Puget Sound Energy.

After eating at Fiamma Burger, customers bus their own tables and sort their trash into compost, recycle and garbage. Only three items end up in the landfill: salad dressing packets, coffee cup lids and tea wrappers.

"When we say we don't have a dumpster, it says something to people," Bothman said.

Plastic-like takeout containers are made from cornstarch, potato starch and sugarcane, which easily decompose. Conventional plastic bags are a third of the price of compostable plastic bags, said Heather Bates, manager of Fiamma Burger.

Fiamma Burger opened as a result of the success La Fiamma Pizza found in making high-quality foods with local ingredients and minimal waste, which is something most customers appreciate, Bothman said.

Restaurants like Fiamma Burger are important environmental leaders because many Americans frequently dine out.

Americans are projected to spend 48 percent of their food money on eating at restaurants in 2008, according to the National Restaurant Association.

Bob's Burger & Brew is a popular burger joint located across the street from Fiamma Burger, and has a difficult time reducing their waste.

"One of the most frustrating things as a restaurant owner is the amount of food we throw away in our garbage," said Pete Wasley, owner of the downtown Bob's Burgers & Brew. "Probably half of the garbage we throw away is food," Wasley said.

Wasley said he would like to integrate more sustainable practices into his restaurant but is not sure how.

Bob's Burgers & Brew uses Styrofoam take-out boxes, which are not biodegradable. Wasley just cut one-third of the restaurant's garbage by recycling. But, he said, he doesn't know how to incorporate procedures like composting.

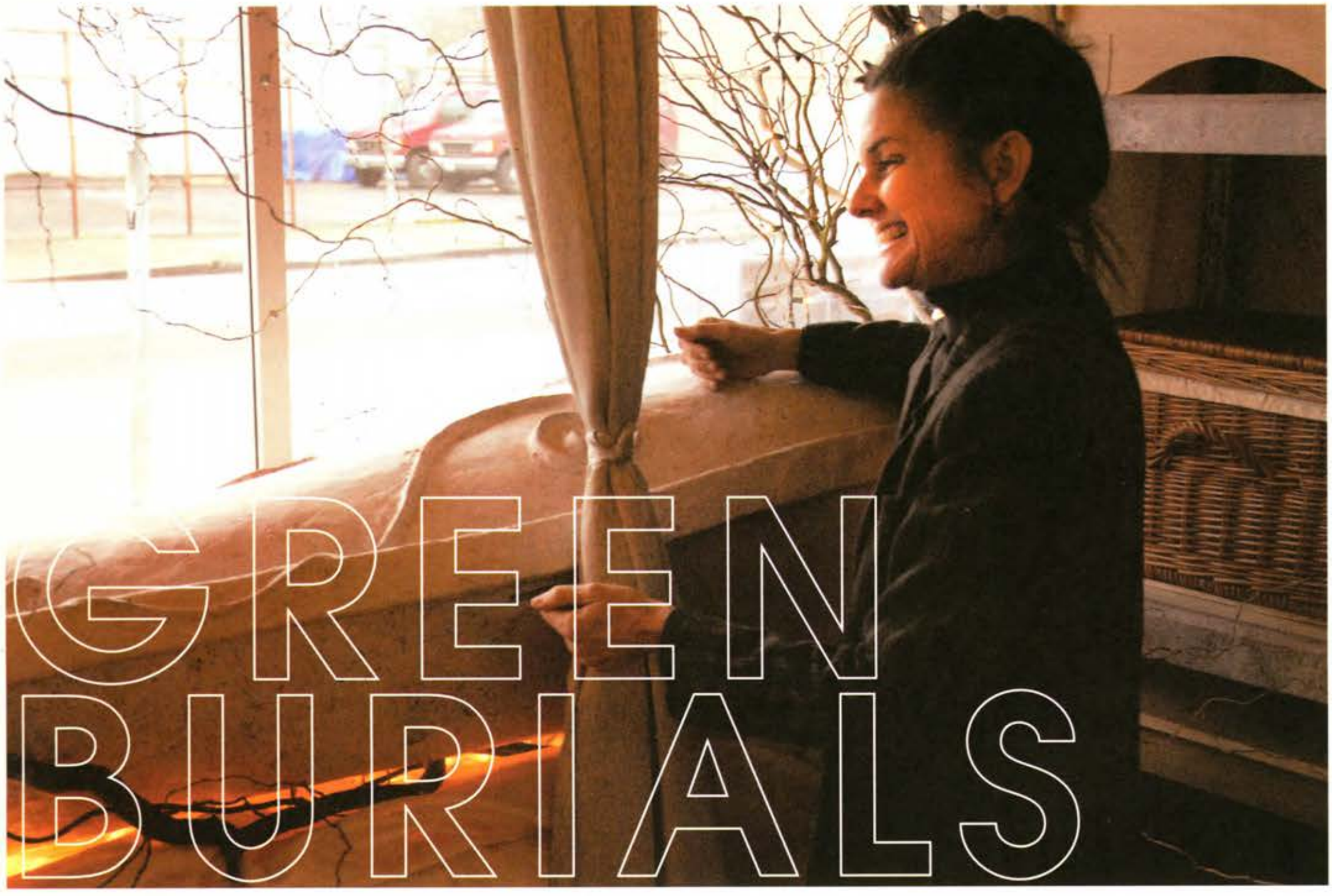
Sustainable Connections is a local organization that works with business owners to improve environmental practices.

Fiamma Burger, a member and leader in Sustainable Connections, has a sophisticated food education system for Bellingham restaurants wanting to minimize their environmental impact.

Oshman said after adding up the health hazards and impacts of our current food system, from an environmental perspective, it's too expensive not to buy green.

**Elise Watness** studies ethno-environmental journalism and Spanish. She has been published in the Licton Springs Review.


DICKENS



# GREEN BURIALS

*When Cynthia Beal kicks the proverbial bucket, she doesn't want to be memorialized with a slab of rock. She doesn't care for embalming, rot-proof caskets or interment in a tidy cemetery lot, either. Beal wants to be a tree.*

Written by **Peter Pearsall**

Photos by **Elizabeth Olwin**

An Oregon cherry tree, to be exact, whose roots will frame her simple grave and draw nourishment from the body within. At the tree's ripe age of 80, her monument will be cut down, kiln-dried and crafted into salad bowls and musical instruments.

Beal owns the Natural Burial Company, a funeral-goods purveyor in Portland, Ore., that specializes in biodegradable caskets and urns. A former organic agriculturalist, Beal applied her interest in nutrient cycling to the ultimate composting endeavor: returning bodies—and their caches of organic compounds—to the biological web of decay, release and re-growth.

The Natural Burial Company is an unassuming hole in the wall outside downtown Portland. Its narrow, softly lit parlor is lined with shelves holding urns and vases; a gallery of plywood, woven wicker and cardboard coffins lie propped against each wall. The Ecopod, a recycled-paper import from the United Kingdom, is their newest offering: an attractive, streamlined coffin made entirely by hand and customized to order.

Laid out in the store's display window is a beige Ecopod, adorned with papier-mache vines twisting and curling across its lid. The arched design looks carefully wrought; only a few nibs of plastered paper jut out along its graceful curves. But this is no showroom demo.

"This is the coffin I'm going to be buried in," Beal said. "I papered it myself."

Beal and company aren't alone in their vision. A natural take on death is gaining credence throughout the United States—and not just among environmentalists. Mortified by the pollution, dubious land use and fossil fuel consumption of the modern funeral, many Americans are seeking a greener way to go.

The premise is simple: return one's remains to the earth as directly as possible and eschew the extravagance. No embalming, no concrete grave liners, no steel caskets. Bodies are buried in readily-biodegradable materials, eventually incorporated into the soil to foster life anew.

"We spend our entire lives eating and building our bodies," Beal said. "It's the ultimate insult to not give anything back."

Natural burial encourages the decay of one's body to fuel biological processes—an end the modern funeral industry strives to prevent at all costs, she said. Nearly every aspect of a modern funeral—from embalming and concrete grave liners to interment six feet below the surface—serves to delay or inhibit decomposition.

Most cemeteries use concrete liners to stabilize their plots, said Marcia Wazny, cemetery sextant for Bayview Cemetery in Bellingham. As a casket breaks down, the liner prevents earth from sinking further into the grave. Such collapses can mar the manicured landscape of a cemetery and pose safety risks to groundskeepers, she said.

"The only purpose of these liners is to make the lawn look nice," said John Eric of the People's Memorial Funeral Cooperative Association in Seattle. "They inhibit the natural decay of the body."

The modern funeral industry spares no expense when interring the deceased. From mahogany coffins in airtight burial vaults to white dove send-offs, modern funerals have become elaborate affairs, costly both for the family and the environment.

According to the Natural Burial Cooperative, the typical ten-acre lot of cemetery ground in the

ABOVE *A papier-mache coffin, designed and created by Cynthia Beal, is displayed in the window of the Natural Burial Company, Portland.*

PREVIOUS LEFT *A grave stone at the Grandview Cemetery in Anacortes, Wash.*

PREVIOUS RIGHT *Cynthia Beal shows off the coffin she designed for herself from paper. The coffin is handmade and fully biodegradable.*

United States contains enough coffin wood to construct more than 40 homes. Buried with the wood are a thousand tons of casket steel and 20,000 tons of concrete, as well as enough embalming fluid to fill a backyard swimming pool. Capping off the facade are untold gallons of Roundup and pesticide to keep the grounds preternaturally green.

"By 2038, I predict many of our private cemeteries will be Superfund sites," Beal said.

Each year, North America puts enough metal into casket production to build the Golden Gate Bridge, according to the Natural Burial Cooperative, and enough concrete is poured into burial liners to pave a four-lane highway from Bellingham to Eugene, Ore.

The American way of death hasn't always been fraught with excess, Beal said. Its roots began rather humbly, based upon the same ideals that define contemporary natural burial.

"Green burial is a return to our traditional funeral practices," she said.

Burying loved ones simply and naturally isn't a novel concept, said Paul Spinelli, funeral director at Moles Funeral Home in Bellingham. Cultures around the world have been naturally burying their dead since the beginning of civilization.

Prior to the advent of embalming fluid or refrigeration, bodies needed to be dealt with quickly, he said. After death, a body's cells, proteins and tissues start breaking down almost immediately and pathogenic bacteria in the stomach and intestines run rampant. For this reason, a traditional burial in colonial America was kept simple: the body of the deceased was washed, dressed, and—following a brief ceremony by family and friends—laid to rest in an octagonal pine coffin.

By the mid-nineteenth century, however, American funerals had undergone marked changes from the rustic family burial, Spinelli said. Elaborate services with hardwood coffins and embalmed remains became standard funeral procedure after the Civil War. To avoid the indecency of a hasty, foreign burial, Union soldiers embalmed their fallen comrades and shipped them home on trains, he said.

Embalming is an age-old practice of preserving the dead. Long used by ancient Egyptians to mummify corpses, modern methods temporarily stall the unsightly effects of decomposition, Spinelli said. An embalmed corpse may hold for more than a week without visible change.

"The embalming fluid acts like a growth inhibitor," he said. "The bacteria can't find the enzymes to break down as food, so they can't multiply."

When embalming a body, the blood is drained and replaced with formalin, a formaldehyde-based solution used to disinfect and preserve the tissue, Spinelli said. Formalin is a mixture of methanol, ethanol and about 40 percent formaldehyde, he said, and is used in funeral homes across the nation, including Moles.

As a casket deteriorates, this chemical cocktail can leach out of the body and into the soil. Even vaults touted as "impervious to the elements" are susceptible; eventually water and embalming fluid will eat away at the concrete, Spinelli said.

According to the Natural Burial Cooperative, formaldehyde is a human carcinogen with potentially toxic effects on the environment. Although the Environmental Protection Agency regulates formaldehyde as a hazardous waste, nearly three pounds of formalin is legally buried each time an embalmed body is interred.

## "By 2038, I predict many of our private cemeteries will be Superfund sites."

As embalming became increasingly popular in post-Civil War America, the role of the undertaker rose to importance, Spinelli said. Families didn't have the knowledge or equipment to embalm their loved ones, he said, so an undertaker was hired to arrange, or undertake, the services needed for a proper funeral.

Over time, the undertaker's duties came to encompass nearly every aspect of the post-mortem process, Spinelli said, and the funeral "director" was born. Funeral parlors—later called homes—were built to accommodate the burgeoning business of death.

And what an enterprise it has become. Modern funeral homes make a financial killing, generating nearly $11 billion in revenue each year, according to the 2004 U.S. Census Bureau. The average funeral and burial can cost upwards of $8,000.

"We sell a service here," Spinelli said. "I get paid whether somebody dies or not."

Funeral homes have become the one-stop death shop. A typical home offers an array of services on-site, including embalming, casket and headstone options and interment in a nearby cemetery, Spinelli said. Some also contract with nearby crematories to arrange cremations and deliver the "cremains" to their clients.

Cremation is often considered the environmentally-friendly alternative to burial, Spinelli said. While incinerating a loved one's remains does save graveyard space, this fiery farewell also burns prodigious amounts of fuel. According to the Natural Burial Cooperative, North American crematoria use enough fossil fuel each year to drive a car nearly 20 million miles—the distance of 84 road trips to the moon and back.

Reducing a corpse to charred bone fragments requires a cremator to burn at 1600-1800 degrees for more than two hours, Spinelli said. As a body's organs and tissues combust, pollutants such as carbon monoxide and mercury vapor—from scorched dental fillings—can escape out the smokestack into the atmosphere.

With nearly 70 percent of Washingtonians opting for cremation, the environmental costs are adding up.

"Cremation is the second-best option, after natural burial," said Kimberly Campbell, vice president of Memorial Ecosystems in Westminster, S.C. "Ashes in an urn aren't doing any harm, but they're not doing any good either."

In 1998 Campbell and her husband, Dr. Billy Campbell, built Ramsey Creek Preserve in South Carolina, the first memorial nature park in the United States. Devoid of embalming fluid and concrete liners, Ramsey Creek's 33-acre woodland bears little resemblance to modern cemeteries. Graves are marked with locally-produced stone and caskets must be biodegradable and hardwood-free, she said.

The memorial parks serve a dual purpose: conserve ecologically valuable land and provide green-minded individuals a place to truly rest in peace.

"We've found a way to conserve land meaningfully," she said. "Our ultimate goal is not to just create cemeteries, but to create ecological reserves."

Ramsey Creek and other memorial parks are protected by cemetery deed contracts, she said. Once a parcel of land is deeded as a cemetery, state laws prevent further development—essentially allowing deed holders to create tracts of undisturbed wilderness.

"In a true green cemetery, buying a plot is buying an ecological easement," Eric said. "It lasts into perpetuity."

According to the National Center for Health Statistics, nearly 2.3 million Americans died in 2003. As members of the Baby Boom generation approach the brink, this figure is expected to double by 2040—fine time to rethink the American way of death.

**Peter Pearsall** studies environmental journalism. He has been published in The Planet and The Western Front.

# OUTBACK IN BUSINESS

Written by **Emily Stebbins**
Photos by **Elizabeth Olwin**

*If it were a person, the Outback Farm would be a neglected child. Rescued from a premature death, its five acres of garden, woods, and wetland were passed from one foster family to the next. The Outback has emerged as an adolescent with an identity crisis. Is it a permaculture farm, an environmental education site, or just a muddy weed patch?*

"I think it's intimidating if you're not a gutter-punky, hippie type."

Tucked into the woods just south of Fairhaven College is the Outback, where beds of beans and rows of rhubarb share a city-block-sized space with a native wetland. Douglas firs and cedars shade the stream, while black cottonwoods send summer snow drifting into the sunny garden.

The Outback was originally farmed by pioneering Bellingham homesteaders. The site escaped a parking lot destiny in the 1970s when Fairhaven students adopted it. More recently the farm's focus has shifted to environmental education, and was officially named the Outback Outdoor Experiential Learning Site.

The Outback's mission statement establishes it as a student-run site "dedicated to teaching, developing and implementing sustainable land use methods." The question is whether the site can leave behind its rag-tag, tumbleweed past and become fully integrated into the campus community.

The Outback has been an educational resource for more than 30 years, but it only recently gained an official position through Associated Students. These days, Outback fans are brimming with ideas for the site. However, many students still don't even know it exists. Newly appointed coordinator, Steve Shaw, said it's invisible to most of campus.

The Outback Amphitheatre, or "Sustainable Stage," is a half-finished monument to the recent peak in Outback inspiration.

Students Casey Hons, Andrew Bernardt, Arin Smith and Trent Eliot began working on the stage in 2005. Made almost entirely with recycled wood, it will feature solar panels and a water catchment system.

"The really tricky stuff is out of the way," Eliot said. "From now on, it's just slapping boards up."

Eliot said the amphitheatre could bring a lot of recognition for the Outback as a theatre and music venue. When finished, it will offer performers solar-powered sound and lighting.

The stage's construction has been organized entirely by students, a feat that has contributed both to its originality and its unfinished state. Over the summer and fall volunteers worked diligently on the amphitheatre, but more recently Eliot said it has been difficult to juggle classes and construction.

"This is the furthest a project like this has ever gotten," said Campus Facilities Manager David Willett, who drew the architectural plans for the amphitheatre.

The Outback attracts a core group of dedicated students who come together for weekend potlucks and work parties. Herb-garden coordinator Amanda Smith said the Outback creates an active community where everyone has a voice in decision-making.

*Sus Arnhart of Bellingham works on improving a gate at Outback Farm.*

*PREVIOUS Planks of wood wait to be added to the gazebo in the Outback Farm. (Photo by Todd Linder)*

*The Outback Farm. Buchanan Towers in background.*

"Whoever has a relationship to the Outback ends up being more involved than they ever thought they would be," Smith said.

Matia Jones coordinates the Educational Garden and is eager for the broader campus community to embrace the Outback.

"I think it's intimidating if you're not a gutter-punky, hippie type," Jones said.

Students hope to make the Outback more inclusive through a garden mentoring program. Experienced gardeners in the community will coach novice green thumbs and tend community plots in the summer when many students leave. The Associated Students Child Development Center might also claim a plot, so preschoolers could get their hands in the dirt.

Willett has a three-inch binder overflowing with student plans and ideas for Outback projects. Students have often enlisted his help in projects they later abandoned.

"People have put a lot of energy into that place," Willett said, "And sometimes you look at it, and you'd hardly know it."

Melanie Swanson, who last year became the Outback's first Associated Students coordinator, said she's frustrated that people forget the Outback's history.

From a historical perspective, the Outback has been dependent on student whims, riding the ebb and flow of transient student enthusiasm. Projects of the forgotten past include maintaining pigs, goats and ducks, solar panels, wind power generators, composting toilets, a cob greenhouse, a sauna and various outdoor theatres.

"It just kind of goes along in stops and starts," Willett said.

Despite waxing and waning student productivity, the Outback may be on its way to greater heights.

For example, Engineers Without Borders is developing an organic digester to convert cow manure and food waste into compost and methane fuel. Engineering student Tori Talkington would not otherwise have been involved in the Outback, but said it could be the perfect place to develop the digester.

Students are also introduced to the Outback through Fairhaven human ecology and ethnobotany classes. Others participate in LEAD, an ecological service-learning program in which students remove invasive plants and restore the Outback's wetland.

LEAD's student co-director Stacia Dreyer said the Outback is an ideal place for students to apply environmental learning.

"Class work can be transferred here, and learning here can be transferred to class," Dreyer said.

Jones said some people are turned off by the grungy aesthetic of discarded student tin can art, cement blocks, and old bathtubs she calls "classic Outback." The ramshackle, recycled feel is charming to some people, but alienating to others.

"We're face-lifting it," Jones said. "I don't know if we'll get the computer science folks coming down there in droves, but we could be more friendly to them."

Students look forward to empowering more people to incorporate ecological learning into their lives.

"You don't have to be a radical leftist dumpster-diver," Jones said. "You can be an accountant and grow vegetables on your balcony. It's part of our inheritance rights as humans."

**Emily Stebbins** studies human ecology, sustainable community Design, and Spanish. This is her first time being published.

# SHROOM VACUUM

Written by **Emily Linroth**
Photos by **Eric Schmitz**

*Lurking in leaf piles and crouching on logs is one of nature's smallest superheroes. It prefers shade to the spotlight, and eats garbage with a vengeance. Behold: the mighty mushroom.*

After centuries of trampling the most efficient recyclers nature has to offer, humans are finally beginning to see mushrooms as more than a gourmet meal. A new tactic in environmental cleanup known as mycoremediation uses fungi to transform environmental contaminants into harmless compounds.

"Humans seem very good at messing things up and throwing systems out of balance," said Erin Moore, a member of the Northwest Mushroomers' Association. "Why not try to use tools like fungi to put them back into balance?"

Myco means "mushroom," and remediation is the process of restoring something to its optimal state. Mycoremediation is a part of mycorestoration, a term coined by mycologist (fungi researcher) Paul Stamets, to describe the use of fungi in aiding the environment.

That's right. Mushrooms eat more than just rotting wood. Give them oil, arsenic or even nerve gas, and they'll give you back water and carbon dioxide.

No, you're not hallucinating. Mushrooms are nature's prime decomposers, and they're very good at what they do. They eat by releasing enzymes capable of breaking down substances from which they gain nutrients. Their usual diet consists of plants and other organic, or carbon-based, organisms.

Since many toxins have similar chemical makeup to plants, fungi can break them down as well. These include petroleum products, pesticides, fertilizers, pharmaceuticals with estrogen, and even neurotoxins. Once the contaminants are broken down, the mushrooms are safe to eat.

Mushrooms can also absorb heavy metals such as mercury, lead and arsenic. A species called oyster mushrooms, Pleurotus ostreatus, have a particularly high tolerance for areas heavily contaminated with cadmium and mercury. This means oyster mushrooms can grow in high-mercury areas and still decompose other pollutants.

Mushrooms that ingest heavy metals are no longer safe to eat, because the toxins remain concentrated in the mushroom instead of being broken down. For this reason, heavy-metal laden mushrooms must be removed after absorption to prevent the metals from reentering the area when the mushrooms die and decompose.

Oyster mushrooms gained national attention after the Nov. 7, 2007 Cosco Busan oil spill, when nearly 60,000 gallons of diesel fuel were dumped into San Francisco Bay. To test the potential of mycoremediation, workers mopped up oily beaches with mats of human hair, which is extremely absorbent. Oyster mushroom spores were introduced and began growing on the mats, decomposing the oil. The result: water, carbon dioxide, compost material suitable for highway landscaping and restored beaches.

Once the oyster mushrooms run out of food, they will die off and decompose naturally, posing no threat to the environment, according to the Environmental Protection Agency.

Mycoremediation was first attempted in Bellingham in 1998, when Stamets and a team of researchers from Battelle Pacific Northwest Laboratories in Sequim, Wash. treated plots in a contaminated truck maintenance yard operated by the Washington State Department of Transportation. Of the four plots, one received mushroom spores, two received bacterial treatments and one was left as a control. After four weeks, the plots not treated with spores remained unchanged, but the spore-rich plot had sprouted a large crop of oyster mushrooms. Over the next five weeks, the

*A Nitrous Bonnet (Mycena leptocephala) on Sehome Hill in Bellingham, Wash.*

mushrooms matured, reproduced and then died. Their life cycle attracted insects, birds and other animals, and life flourished on the once-dead plot.

Mycorestoration was also used to filter contaminated water after Hurricane Katrina's rampage through the Gulf Coast States in 2005, according to the National Institute of Environmental Health Sciences. Mushrooms are also capable of breaking down infectious agents such as E.coli and staphylococcus bacteria, according to Stamets' book "Mycelium Running: How Mushrooms Can Help Save the World." Fungi have also been used at Superfund sites, some of the most toxic hazardous waste sites, throughout the nation.

Mycoremediation has potential for future expansion. Mushrooms could be used to break down pesticides released from Whatcom County farms before they reach rivers and the food chain. Fungi could take up heavy metals from the Georgia Pacific site, restoring the land more rapidly to pave way for Bellingham's future waterfront development.

Mycoremediation has many benefits compared to traditional cleanup processes, according to the United States Geological Survey (USGS). Since mycoremediation can be carried out at the contaminated location, the site doesn't need to be disrupted, preventing the release of more toxins. Also, mycoremediation is a completely natural process requiring minimal supervision, making it much cheaper than more institutionalized methods such as incineration.

The success of fungi is due to their nature and their structure, according to Dr. Fred Rhoades, a biology professor and avid mycologist at Western Washington University.

Fungi are different from plants because they cannot produce their own food. Because of this, many species work with plants or bacteria to break down other substances into nutrients, which they then absorb.

"It's a fantastic relationship," said Moore. "These fungi actually grow on the very fine, absorbing tree roots, just like a glove on a hand."

The fungi carry nutrients and water to the trees, which feed sugars to the fungi.

Fungi also have a much different structure than plants. Although the mushroom itself is the most popular image we have of a fungus, it actually only makes up a small part of the organism.

The mushrooms we see are fruiting bodies – they produce spores, much like the fruiting parts of a plant produce seeds. Mushrooms are part of a larger organism known as the mycelium. All fungi are made up of mycelium, even those that do not form mushrooms.

"The mushroom is like the apple, and the mycelium is like the apple tree," Rhoades said.

Mycelia (plural of mycelium) are complex webs of hair-like fibers that resemble the neurological pathways in the human brain. Although only one cell wall thick, mycelia are responsible for cycling nutrients through the fungus and its surrounding environment, according to Stamets' book.

Mycelium mats can grow very large and connect entire forests in a nutrient-sharing network. One specimen covered more than 2,400 acres on an Oregon mountaintop; possibly the largest living organism, according to the journal "Nature."

## "Humans seem very good at messing things up and throwing systems out of balance"

Some fungi will decompose anything that provides them with nutrients, Rhoades said, but others are picky eaters. Mycoremediation occurs most successfully when mycelia of local mushrooms are bred to target specific contaminants, according to Stamets' book.

Since mycoremediation is an emerging field, plenty of testing must be done before it can be used on a wide scale, according to Stamets' book.

Mushroom enthusiast Angus Tierney of Evergreen State College, Wash. believes mycoremediation would profit both the environment and the mushrooms themselves.

"All life on earth benefits from a toxin-free environment, including mushrooms," Tierney said. "If mushrooms were extensively used in this way, it could change many minds that correlate them with putrid rot and poison into seeing how mushrooms are healing."

**Emily Linroth** studies environmental science. She has been published in The Planet.

*Fred Rhoades holds up a Scarlet cup Fungus (Sarcoscypha coccinea) on Sehome Hill in Bellingham, Wash.*

*LEFT A Fomitopsis cajanderi on Sehome Hill in Bellingham, Wash.*

# Green Collar Restoration

*Written by* ***Anna Renzetti*** *Photos by* ***Eric Schmitz***


*Arron Leonard stands in the Post Point Lagoon in Fairhaven, Wash.*

*Under the summer sun, members of the Washington Conservation Corps construct trails beneath the canopies of Bellingham's forests or plant saplings at new city parks. During the cold months, they tend to creeks, monitor salmon downstream and respond to natural disaster emergencies across the state. Now, with a local Bellingham ecosystem at risk, the Corps has come to the rescue again.*

A number of young adults have made the commitment to provide up to a year of service to their local communities through the Washington Conservation Corps (WCC). Through rehabilitation, conservation and enhancement of their community's most valuable natural and recreational resources, members of the WCC gain experiences and skills for their future outside the classroom.

Off Harris Avenue, across the old railroad tracks and past the wastewater treatment plant, a muddy trail leads to the small, glassy Post Point Lagoon where the current WCC Bellingham crew is working on its most recent project.

On a brisk January morning, WCC Bellingham Crew Supervisor, Vanessa Lott and five of her crew members worked in the lagoon mud. Wearing fluorescent yellow vests and hard hats, they installed silt fencing to help restore vegetation around the lagoon that was torn up by rambunctious dogs.

"Our group is working to take a site from a very low habitat value and try to improve it by planting and tending to native plants and maintaining the areas until they can mature on their own," Lott said.

The Post Point Lagoon project is one of the more important restoration projects for the Corps this year because they are protecting a natural habitat for a variety of species, such as salmon and the great blue heron.

The Bellingham WCC's projects consist primarily of maintenance work during the spring and summer seasons, Lott said. This includes mulching, planting trees and removing invasive weeds hazardous to native species.

Arron Leonard, 20, a new Bellingham crew member, stands with one muddy boot on the blade of his shovel, his hands grasping the worn, wooden handle. His yellow hard hat glows in contrast to the gray shoreline of the lagoon. Still gazing into the distance, Leonard said he feels lucky his job doesn't feel like work.

"It's a great place to work in the sense that I'm not cooped-up inside all day," Leonard said. "I get to work around some amazing species. We see great blue heron hang out by the lagoon every day and we see eagles fly over the trees while we work."

Growing up around forests and hiking is what interested Leonard in working for the Corps. Until joining a crew, he said he never understood the hard work that goes into making trails and parks.

"There's a select group of people who go out of their way, that take the initiative to repair and build trails," Leonard said. "Basically we help facilitate the outdoors for other people."

In the past few years the WCC has taken on some of the most challenging environmental projects in the Bellingham area, said Sue Madsen, environmental coordinator for the Department of Ecology.

During a harsh rainstorm in 2006, they transported salmon downstream, so the salmon could spawn and be monitored near Cemetery Creek, Madsen said.

"I was just amazed by the willingness of these kids to get out at four in morning or be out there at 2 a.m. moving fish," Madsen said. "It goes above and beyond the call of duty and they take that on while being enthusiastic about it and they have a good time," Madsen said.

As a Washington State Department of Ecology program, the two WCC crews in Bellingham are sponsored by the City of Bellingham.

"We can really save the city and the citizens a lot of money by having the WCC crews take on some of these restoration projects; doing the replanting or some light construction work that we'd otherwise be paying consultants city dollars for," Madsen said.

In 2007, the WCC Bellingham crew was recognized by the City Council and Mayor Tim Douglas for their outstanding service in support of the city's habitat restoration, according to the WCC Web site. They were also named top conservation crew of the quarter in Washington by the Department of Ecology for raising over $25,000 for the Bellingham Food Bank.

Along with environmental restoration in Washington, the Corps also responds to emergencies outside the state. In 2006, the Bellingham crew spent two weeks in New Orleans repairing houses damaged by Hurricane Katrina.

Closer to home, Lott and her crew filled and stacked sandbags next to overflowing rivers during the Chehalis, Wash. floods this past December. Leonard said he joined the cleanup through the Red Cross, while others gave a helping hand in emergency shelters for victims of the floods.

"We got to see the affects the flood had on them," Leonard said. "We stopped by dairy farms where people lost their whole lives, their barns, their cattle, and their income. It was rewarding to actually help."

According to the Washington State Department of Ecology, today the Corps currently has up to 135 members, 26 crews and is stationed in 14 counties around the state. Members work four days a week, earn $7.93 per hour, receive a $4,725 AmeriCorps Education Award for completion of one year of service or 1700 hours, and are provided basic medical benefits.

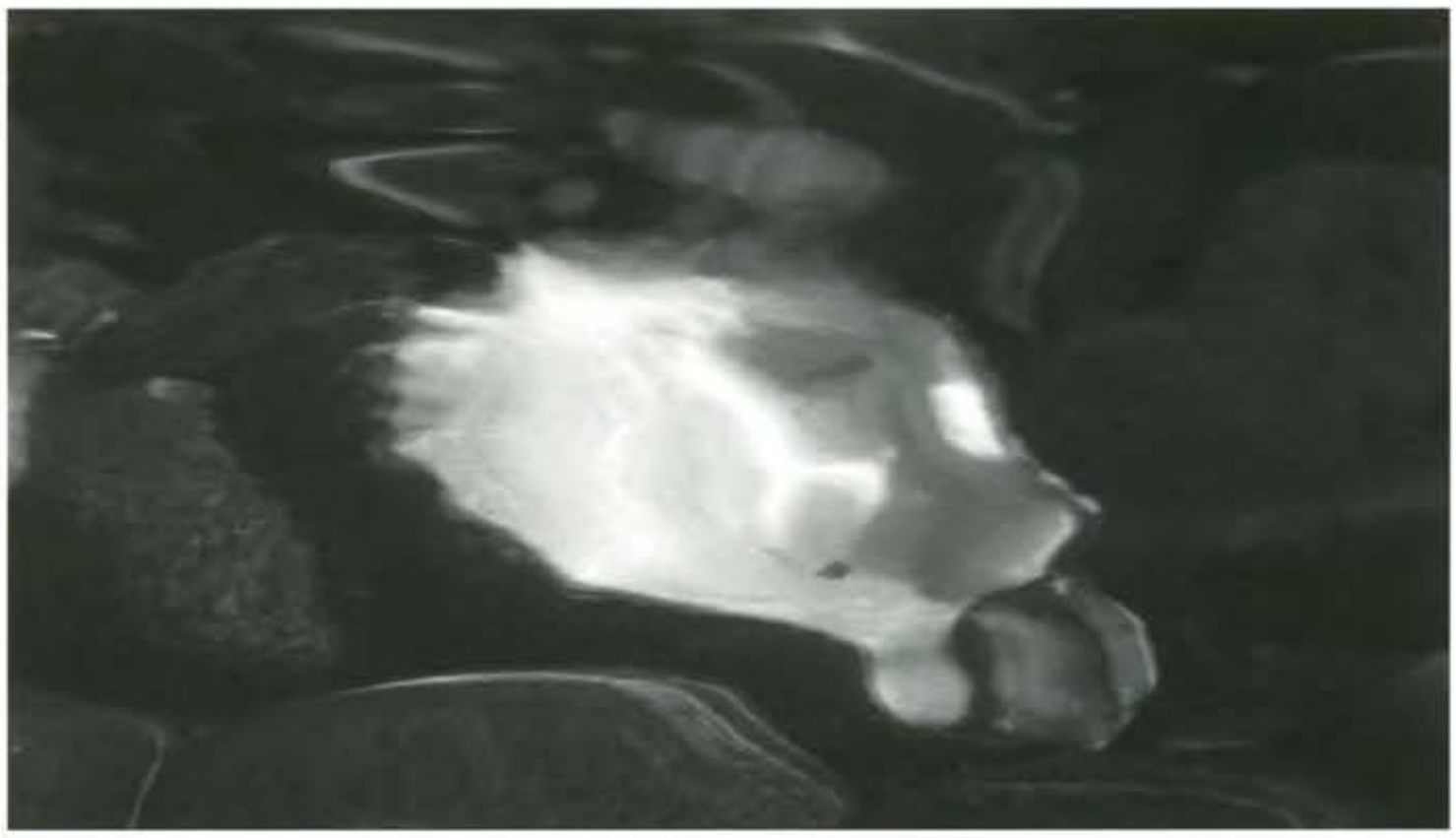
As the Corps gives back to the community, the community should be thinking about giving back to the WCC and the environment they are protecting, Edwards said.

"If funding from the city should dry up or be redirected, what would be the outcome?" Edwards said.

As Volunteer Coordinator and a concerned Bellingham resident, Edwards believes that in an urban environment residents need to utilize and recognize those individuals who take the time to protect and monitor Bellingham's valuable natural resources.

"One day we may not have these groups and then the responsibility will be on us," Edwards said.

**Anna Renzetti** studies communications. She has been published in The Western Front.



*A discarded clamshell sits at the bottom of Lummi Bay. (Photo by Erin Middleton)*

# Tainting Traditions

## A Northwest Culture in Crisis

Written by **Natasha Walker**

*There is an ancient Native American saying that when the tide goes out, the table is set. This saying still holds true for many of Washington's coastal tribe members. Every year, when the tide is just right, they travel to ancestral beaches with the same fervent objective as their forefathers – to harvest and store.*

*Tyson Oreiro returns oyster shells into Portage Bay (Photo by Natasha Walker)*

But the very fabric of this tradition is in jeopardy. A muddle of contaminants, both natural and introduced, are lurking in Washington's waters and accumulating in the tissue of unsuspecting bivalves with each pulse of the tide. And while federal and state organizations attempt to employ strict water quality standards for acceptable levels of pollutants, flaws in risk assessment practices may be placing coastal tribe members' health in peril.

A member of the Lummi tribe, Tyson Oreiro has been gathering oysters, clams and mussels from the shores of Lummi Bay since he was a child.

His ancestors have always been gatherers. His father was a shellfish harvester, and his father before him.

Shellfish have offered his family sustenance, income, ceremonial provisions and—perhaps most importantly—a link to the past.

"My grandmother used to always put it like this – when we are eating our traditional foods, it's like feeding our heritage," he said. "She used to always say, 'I'm feeding my Indian.'"

But the shellfish that have nourished the Native American spirit for generations come at a price these days.

Contaminants such as methyl mercury, fecal coliform and domoic acid are filtering into Washington's shellfish. While the fish they reside in often remain unharmed, these pollutants pose considerable health risks when ingested by humans.

According to the Environmental Protection Agency (EPA), methyl mercury has been attributed to developmental deficits in children. Fecal coliform bacteria, often a result of untreated sewage, have trickled into Washington's bays, carrying a potential array of viruses. Domoic acid, a deadly neurotoxin created by a class of phytoplankton, has extended its annual stay in Washington, said David Fyfe, a shellfish biologist for the Northwest Indian Fisheries Commission.

And that is just to name a few.

A considerable number of studies off Washington's coasts have measured the effects of these pollutants. Over the past few years, however, the EPA has been working to recognize communities particularly at risk for health hazards posed by marine pollutants and some researchers have begun conducting assessments with large-scale consumers in mind.

*A member of the Lummi Tribe digs up clams in Lummi Bay during low tide at roughly 9 p.m. (Photo By Erin Middleton)*

The significance of dosage, or the amount of shellfish consumed, has sparked a flurry of seafood diet surveys and has brought specific attention to large-scale consumers such as coastal Native Americans.

In 2002, the EPA awarded Huxley graduate Jamie Donatuto a $1.2 million grant to explore possible acute and chronic health risks posed by toxicants in the shellfish consumed by the Swinomish tribe of La Conner, Wash.

Her team performed seafood diet surveys to determine how much shellfish Swinomish members were ingesting, as well as how much they wished they could eat.

Though data has not been published yet, Donatuto said she discovered seafood consumption rates are far higher than those of the average non-tribal American.

Preliminary estimates of daily consumption for the Swinomish tribe were around 300 grams of seafood per day, nearly 50 times the 6.5 grams per day, or one seafood meal a month, that Washington State lists for setting water quality standards, Donatuto said.

Joan Hardy, a toxicologist for Washington's Environmental Health Assessment Department, said she uses upper seafood consumption rates in her evaluations.

"I have a particular concern to protect any high-risk populations," Hardy said. "We have to ask ourselves, given the levels of contaminants and given what we know about consumption rates, are there any populations exceeding the recommended daily intake?"

Already, the EPA has raised their default consumption rate used in national health risk analysis from 6.5 to 17.5 grams per day. Lon Kissinger, a risk assessor for the EPA, said they have also begun to propose a 142.4 gram per day rate for assessing risks of coastal tribe communities.

But even this number, Donatuto said, may still not be protective enough of Washington's harvesting tribes.

Another dispute brewing among risk assessors involves the calculation and inclusion of cultural risks in health hazard evaluations.

For many Native Americans who have been consuming shellfish as part of a subsistence-based lifestyle for generations, the fear of cultural loss may be far more pressing than any biological one.

"It's all a part of our historical tradition," said David Oreiro, adjunct faculty at Western and vice-president of the Northwest Indian College. "The whole idea of not eating shellfish anymore, it'd be really foreign to me. If I wasn't able to go out and pick up an oyster or go out and get a clam, that's basically like not speaking your language anymore."

Beach closures due to high levels of pollutants are only enforced on commercial and recreational harvesters and Native American ceremonial and subsistence harvesters can continue to gather and consume shellfish, despite contaminant warnings, Fyfe said.

"If you tell them they might have a chance of getting sick from the shellfish, they think about it, and it really bothers them," Donatuto said. "But they're not going to stop eating it, because the cultural significance outweighs any health risks."

The inability to consider such cultural risks is a definite failure in the EPA's risk assessment procedure, Lon Kissinger said.

The problem is that risk assessors like Kissinger have to follow policies that approach health hazards from a solely scientific point of view, said Donatuto, who worked with Kissinger on the Swinomish project.

"Risk assessors need to quantify things, to put a number to it," Donatuto said. "They can't really fit their mind around non-numeric issues like cultural loss."

The solution then is about as complex as the contaminants themselves. Even if water quality standards become more stringent, who determines what levels of pollutants are still acceptable for habitual shellfish consumers? And will assessors consider all risks for Native Americans, both biological and cultural?

It took over a century for the Puget Sound tribes to ensure their treaty rights to a particular quantity of fish. How long will it take to ensure quality?

**Natasha Walker** studies environmental journalism. She has been published in The Western Front.

*Larger temperate climate bamboo plants are stored outside at Boo Shoot Gardens.*

# Raising Cane Against Carbon

*Written by* **Allison Rock** *Photos by* **Kevin McMillon**

***The green canes stand four feet high, and sway lightly in the breeze. The rustle calms. Most assume at best bamboo is just panda fuel — at worst an invasive species. They don't know bamboo's recently uncovered secret.***

The real powers of bamboo cannot be seen. Bamboo is unique because it absorbs four times the amount of carbon dioxide ($CO_2$) and produces 35 percent more oxygen than trees of its same size.

"I see bamboo offsetting global warming," said Jackie Heinricher, founder of BooShoot Gardens in Mt. Vernon, Wash. "It is so fast and so effective, in the short term it could really make a difference."

For every hectare planted, or about two football fields, bamboo will sequester 62 tons of $CO_2$. In contrast, young forests of the same size are only able to take in about 15 tons of $CO_2$, Heinricher said.

For decades gardeners have feared bamboo for its reputation as an uncontrollable weed. Few are brave enough to take on the plant, because of this myth. However, Heinricher has worked for the past 10 years to change the negative image of bamboo and turn it into an accepted mainstream product.

In the BooShoot lab, scientist Andy Burr has successfully cloned both running and clumping species of bamboo in the lab, and has created what Heinricher calls a "magic potion" for cloning dozens of species of bamboo.

Next to the small BooShoot Garden lab, a large room illuminated by fluorescent lights is lined floor to ceiling with giant metal shelves. The shelves are home to approximately 40 different species of bamboo. Each of the tiny plants is a clone that will grow to be about three inches tall.

Cloning occurs when a sample of a sterilized plant, a seed, an embryo or a node is placed in a test tube with a mixture of fertilizers, salts, vitamins, sugars and plant hormones. If the plant grows and multiplies, the clones are placed in small plastic containers for six to eight weeks where they will grow strong enough to survive outside a lab. Burr has successfully used the magic potion for eight years, developing a particular mixture for each species.

"There are lots of variables that are specific to each species," Burr said. "Out in the world it's not so specific. That's what makes it hard."

It is easy for gardeners to pick the wrong species of bamboo, and doing so often results in unwanted expansion. All bamboo species are divided into two categories and each grows radically different. It is a terribly misunderstood species, Heinricher said.

Bamboo canes are separated into segments called nodes, the origin of bamboo branches. In the wild, running bamboo expands freely creating thick dense forests— the opposite of what most gardeners want.

In contrast, the root system of clumping bamboo is compact and expands only a few inches each year— making it a more practical choice for gardeners. Running bamboo creates the largest and hardest timbers and is the best for manufacturing products.

This year, BooShoot Gardens hopes to produce one million bamboo plants to send to nurseries and garden centers around the country.

## "Plant a Boo, Save a Planet, Let's Raise Some Cane."

*Nancy Liles splices bamboo seedlings to produce multiple plants from what was previously one plant.*

"I didn't start with these exact goals in mind," Heinricher said. "It wasn't until we broke through the technology that we knew we would be able to go this far."

Although there have been a couple of successful bamboo clones prior to Burr's system, none have been able to effectively produce a wide variety of cloned species on such a large scale.

"It was hard to believe no one else had successfully figured out how to clone bamboo before me," Burr said.

There are more than 1,200 types of bamboo and many can grow in cooler climates like the Pacific Northwest. Some of these species can also be successfully grown in the hot, humid climates of the Southeast United States. While some species of bamboo provide ground covers approximately two feet tall, others like the Moso species can grow up to one foot per day, eventually reaching the height of a ten-story building.

It may take decades for a forest of trees to be ready for harvest, but because bamboo is a grass its stalks can be cut down and will re-grow canes ready for harvest about every five years.

Heinricher and her team are working on a number of projects for bamboo production beyond their current market, which is focused on nurseries and garden centers. One of these potential markets is agriculture.

Many of the timber species of bamboo can be made into products like kitchen tools, hardwood floors, paper and textiles. Phyllostachys dulcis or "sweetshoot bamboo" is also part of diets in countries like Japan, China, Indonesia and Taiwan.

Bamboo grown in the United States for products like textiles and kitchen tools may have the potential to help reduce the pressure on natural bamboo forests in Asia. Not only are ancient forests being harvested for products, many animals native to these forests are losing their natural habitat.

"The pressure on bamboo is greater than what it can sustain and support," Heinricher said.

One of the major emerging markets for bamboo is textiles. Cotton can require up to one pound of pesticides for every three pounds of product. In contrast, bamboo needs very little, if any pesticide treatment.

Many fashion designers are beginning to incorporate bamboo material into their designs for a soft silk-like material. Outdoor clothing companies are also designing thermal clothing with bamboo fibers.

"Wool will keep you warm when it is wet and does not have an odor but it can feel clammy. Polypropylene will keep you dry but it can have a bad odor," said Will Hamby, employee at Back Country Essentials in Bellingham. "Clothing made with bamboo fibers keeps people dry, warm and has no odor."

David Knight, owner of Teragren, a bamboo flooring company on Bainbridge Island, has been using the Moso species of bamboo since 1994. Knight chose to use bamboo because it is harder than most woods used for flooring, can withstand changes in humidity better than most woods and has the ability to sustain itself even after a number of harvests.

"The goal is to create products that are mainstream and exotic and try not to cut down forests, by taking canes only when they are at the right age," Knight said. "The system we use does not clear cut a forest. We ensure that we make the smallest environmental impact possible."

While bamboo has yet to be a major interest for climate-change activists, farmers and the everyday gardener, BooShoot Gardens hopes bamboo interest will find a place in all three communities. As the demand for bamboo products grows in the United States and around the world, its availability and cost will depend on the ability to domestically produce bamboo as an agricultural product.

"BooShoot founded itself on not only creating a product, but educating. We have really set the bar high for education," Heinricher said.

To educate the public about the capabilities of bamboo and to promote bamboo forest preservation, Heinricher has created a campaign slogan: "Plant a Boo, Save a Planet, Let's Raise Some Cane."

"My deep perspective is that I've driven this cause for all the good reasons," Heinricher said. "We think it will play an important role in global warming education."

Heinricher's cloning discovery makes a future flush with cane possible: biodegradable products with zero petrochemical plastics. Houses built from bamboo timbers, entire closets stocked with bamboo fiber clothes, and bamboo dining room tables laden with bamboo feasts served on bamboo dishes. A future of raised cane.

**Allison Rock** studies public relations and art history. She has been published in The Western Front, Klipsun and The Planet.

# ON ASSIGNMENT

I left the car and stood in awe at the sheer number of bald eagles in the vicinity. It looked as though every eagle in Whatcom County was by the bay that day and they seemed determined to give us a show. Making sure not to make any sudden movements as I snuck closer. Then I waited and shot when I saw them wheeling toward each other. – Erin Middleton

# WITH THE PLANET

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The crucified planet Earth,
should it find a voice
and a sense of irony,
might now well say
of our abuse of it,
"Forgive them, Father,
They know not what they do."
The irony would be
that we know what we are doing.
When the last living thing
has died on account of us,
how poetical it would be
if Earth could say,
in a voice floating up
perhaps
from the floor
of the Grand Canyon,
"It is done."
People did not like it here.
-Kurt Vonnegut